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CASE STUDY OF JEEDIMETLA EFFLUENT TREATMENT PLANT LIMITED (JETL), HYDERABAD, TELNAGANA

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ABSTRACT

The present study aims to evaluate the waste water management system in Jeedimetla effluent treatment plant limited, Hyderabad. Industrial Estates have become common feature of global landscape. Industrialization and pollution are like two side of the same coin. The goods and services are the result of Industrialization, which leads to the pollution of water, air and other natural resources. So, the need for treatment of waste water is utmost important in the environment perspective. Industrial waste contains toxic compounds have their own adverse effects which in turn effects ground water, which stimulates the growth of aquatic flora and fauna. So, the Effluent released from the industries cannot be directly disposed onto the land, they need some treatment before disposal to avoid contamination of soil, ground water etc.., that contain unacceptable amounts of suspended solids, dissolved solids, minerals etc.., which are dangerous when disposed without treatment.

In the present study different Physico chemical parameters were analyzed like PH, Temperature, BOD, Oil & Grease, SS, Ammonical nitrogen as N, Chemical Oxygen Demand, Lead, Total Chromium, Copper, Zinc, Nickel, TDIS, Cyanide, Chloride, Sulphate, Phenolic Compounds, Arsenic as As, Cadmium as Cd, Flouride as F, Boron as B, Total Residual Chlorine, Total Nitrogen, Sulphide as S. The report emphasizes on the biological treatment process of combined waste water, design their operation and maintenance and also the safety measures that are to be taken. The process achieves 90% BOD removal.

Key words: CETP Performance Monitoring, Common Effluent Treatment, Common Effluent Treatment Plant, Performance Monitoring, Waste Water treatment.

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1. INTRODUCTION

Developing countries have poor waste water management water is returned to the Surface water body directly without an adequate treatment, leading to reduction of the water quality and deterioration of the environment [1]. Rapid industrialization is adversely impacting the environment globally. Pollution by in appropriate management of industrial wastewater is one of the major problems in India [2].

Water crisis has global concern due to rapid industrialization and urbanization in the past few decades. Water is a vital necessity that all people need in order to survive .There are both supply –side threats and demands-side threats to water necessary to meet human needs[3].

The number of estates has increased dramatically in the more developed countries and especially in the rapidly industrializing countries of Asia. Industrialization and pollution are like two side of the same coin. The goods and services are the result of Industrialization, which leads to the pollution of water, air and other natural resources. So, the need for treatment of waste water is utmost important in the environment perspective. Industries consume large amount of water for their process but only a fraction of water is used in the process. The rest finds its way into the drain as waste water. If this untreated water is allowed to accumulate it causes the decomposition of organic material thus leading to the production of large quantities of harmful gases. Industrial waste contains toxic compounds have their own adverse effects which in turn effects ground water, which stimulates the growth of aquatic flora and fauna. So, the Effluent released from the industries cannot be directly disposed onto the land, they need some treatment before disposal to avoid contamination of soil, ground water etc.., that contain unacceptable amounts of suspended solids, dissolved solids, minerals etc.., which are dangerous when disposed without treatment.

To address the issue of pollution coming out from industries, adoption of cleaner production technologies and waste minimization initiatives are being encouraged [4]. Most of the small and some medium scale industrial units cannot afford to set-up their own effluent treatment plants to meet the prescribed pollution control norms. This has been become responsible to originate the concept of common effluent treatment plant (CETP).

The concept of effluent treatment, by means of a collective effort, has assumed reasonable gravity by being especially purposeful for cluster of small scale industrial units. Common effluent treatment plant not only help in the industries in easier control pollution ,but also act as step towards cleaner environment and service to the society at large. Waste water of individual industries often contain significant concentration of pollutants; and to reduce them by individual treatment provides a better and economical option because of the equalization and neutralization taking place in CETP. In this over all country wise different effluent treatment plants were established (Fig 2).

1.1. CETP (Common Effluent Treatment Plant) and its Concept

CETP was originally promoted by the Ministry of Environment and Forests (MoEF) in 1984 for the purpose of waste water treatment from a large number of small and medium scale industries [5]. Common effluent treatment plant is considered as one of the viable means for small to medium enterprises for having effective waste water treatment solution.

CETP (Common Effluent Treatment Plant) is the concept of treating effluents by means of a collective effort mainly for a cluster of small scale industry units. The main objective of CETP is to reduce the treatment cost for individual units while protecting the environment [6]. CETP is adoptable to achieve economies of scale in waste treatment, thereby reducing the cost pollution abatement for individual factory. To minimize the problem of lack of technical assistance and trained personal as fewer plants require fewer people. It reduces the problems of monitoring for the pollution control boards and to organize the disposal of treated wastes and sludge and to improve the recycling and reuse possibilities [7].

CETP provides different advantages like savings in capital and operating cost of treatment plant. It offers economies of scale in waste treatment thereby reducing the cost of pollution abatement for each individual factory of industrial cluster; minimizes the problem of lack of trained personnel related to treatment plant expertise; solves the problem of lack of space to be allocated for treatment facilities and monitoring problems are also reduced [8]. Combined treatment is always cheaper than small scattered treatment units. The neutralization and equalization of heterogeneous waste makes its treatment techno-economically viable. Disposal of treated waste water & sludge becomes more organized. It also reduces the burden of various regulatory authorities in ensuring pollution control requirement [9].

2. AIM AND SCOPE OF THE RESEARCH STUDY

Aim of this research study has been set to focus on the cost analysis, design and performance aspects of waste water or common effluent treatment plant. Common Effluent Treatment Plant related effluents are relevant point sources for residues of these compounds in the aquatic environment [10]. However the scope of the research study has been limited to present the evaluation of performance of CETP from the perspective of treatment processes and its efficiency in terms of process indicator values of physical, chemical and biological properties.

3. PERFORMANCE EVALUATION OF TREATMENT PROCESS

Performance evaluation of the actual treatment system process for a CETP involves physical, chemical and biological treatments. Physical treatment mainly separates solids from the waste water using mechanical screens, sedimentation and flotation, most chemical treatment of waste water involves the use of chemical to remove specific wastewater constituents. Preliminary treatment, primary treatment processes are mainly physical. Chemical treatment methods include neutralization to maintain optimum pH for biological treatment processes, precipitation reactions for removal of dissolved solids and phosphorus and Oxidation (chlorination, ozonation, ultraviolet radiation) for disinfection and odor control. Biological treatment processes are used primarily for secondary treatment and use microbial action to decompose suspended and dissolved organic matter in wastewater. Biological treatment processes include natural methods and engineered methods. Generally, industrial waste waters from manufacturing have lower BOD: COD ratios and higher levels of toxic substances [11].

4. STUDY AREA

4.1. Jeedimetla Effluent Treatment Limited

CETP at Jeedimetla is established in 1989 in phased manner by industries, Jeedimetla Industrial Estate is situated at a distance of 20 K.M from Hyderabad city. It is accessible by road maintained by Hyderabad Municipality and is within the residential commercial area of

Hyderabad city. It is spread over 450 hectares was the first to be developed by Andhra Pradesh Industrial Infrastructure Corporation (APIIC) in 1975.

Entrepreneurs from Jeedimetla Industrial Estate in 1987, had jointly formed a CETP public limited company called M/S. Jeedimetla Effluent Treatment Ltd (JETL)(Fig 1), to address the waste water treatment problems of small and medium scale industrial units [12].

It is possible to separate existing CETPs in to two groups: industry cluster containing relatively homogeneous industries and heterogeneous. Industries producing similar goods are called Homogenous for e.g. tanneries; paper etc. and Industries producing widely divergent goods are called heterogeneous for e.g. chemical, diary, soft drinks and pharmaceuticals etc [13].

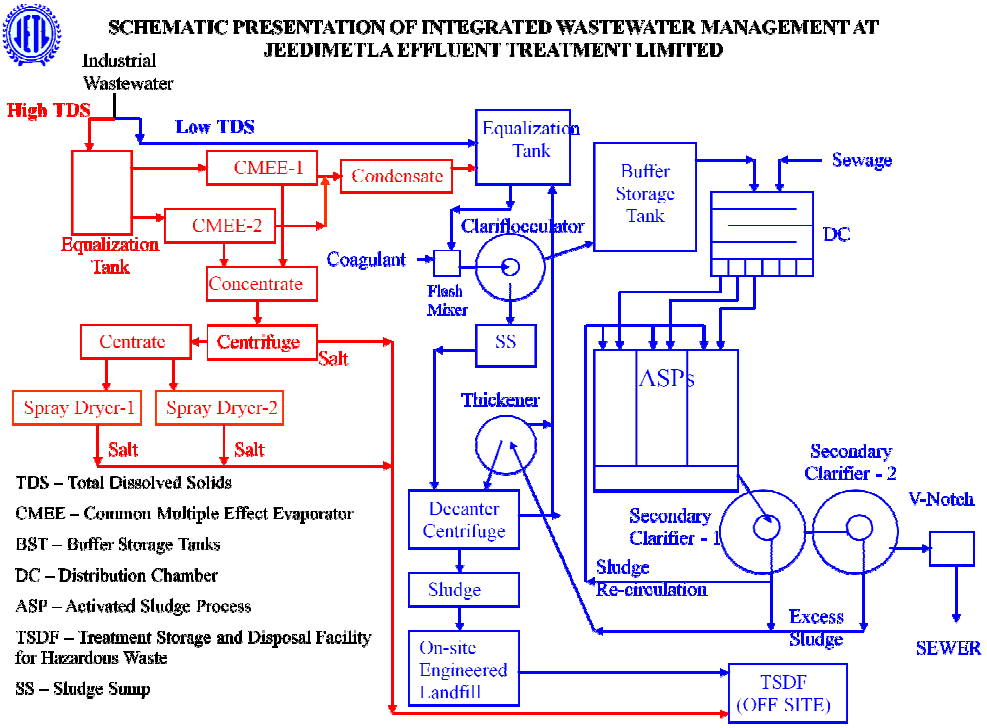

Figure 1 Source: The gazette of India: Extraordinary-Part II- Sec.3 (i) pp 10 Dt.27th Feb 1991

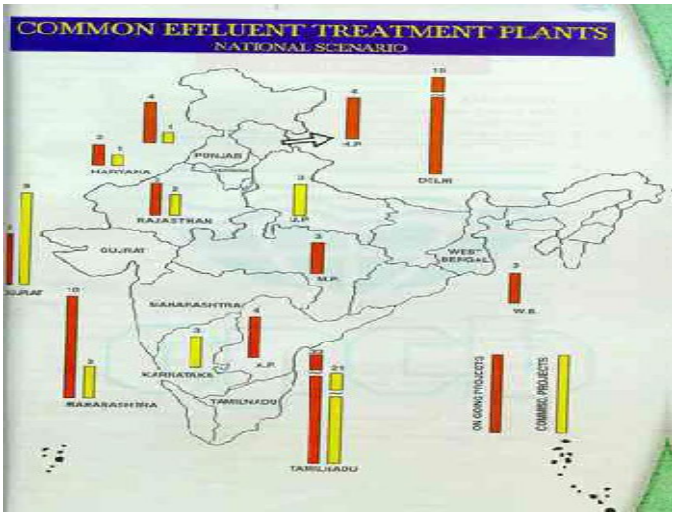

Figure 2 Source: CPCB Central pollution control board, http://www.cpcbenvis.nic.in/newsletter/etp-nov-2000/nov2000.htm

Marching ahead in its commitment for clean environment, JETL (Fig.1.) has the distinction of being the first ever co-operative effluent treatment plant in India. The uniqueness is further highlighted by the fact that is entirely self-financed by its member units numbering 70, majority of which are in the small and medium scale sector. Individual enterprises have to spend much on environment management. Further a centralized facility for waste management brings reduction in environmental liability for individual units.

4.2. Collection System

Two alternatives were considered for collection and conveyance of waste waters from individual units to the common effluent treatment facilities. They are: (i) properly designed and well laid out drainage system connecting various units within the estate (ii) collection and conveyance of industrial waste waters by tankers [14]. Both these alternatives will add to the capital cost. Collection and conveyance of waste waters by tankers would mean lower initial expenditure and easy maintenance. It would also ensure better control over quality and quantity of waste contributed by individual units. Considering the above, it was decided to provide collection and conveyance of industrial waste waters by tankers.

4.3. (CWWTP) Combined Waste Water Treatment Plant

Jeedimetla Effluent Treatment Limited has to handle heterogeneous waste water received from a variety of chemical industries. The waste water characteristics are highly varying due to changes in product mix made from time to time in the member units. It was found highly problematic to obtain uniform characteristics in the wastewater, although it was possible to achieve hydraulic equalization. The CETP had problem in stabilizing its operation. To improve the overall performance of the CETP a number of laboratory and pilot plant studies were carried out. Based on those studies the following recommendations were made by the consultant. A Buffer tank has been added so as to provide uniform organic loading to the activated sludge process. Domestic sewage has added to the industrial effluent for effective biological treatment. The industries that were also sending sludge's and solids along with waste water have to segregate them and dispose of separately and no such solids should be accepted at the CETP.

JETL Laboratory is recognized as an Environmental Laboratory by the Ministry of Environment and Forests (MoEF) Govt. of India Vide: S.O.2039 (E) DATED 05-09-2012.

JETL has fully fledged Environmental Laboratory for the analysis of various environmental samples such as: Water, Wastewater (Domestic and Industrial), Sludge and Sediments, Ambient Air Quality, Stack Gas Monitoring and Noise Monitoring. JETL in engaged in preventing pollution by treating industrial waste waters to environmentally acceptable norms taking it as a social responsibility. We are committees to continual improvement of quality of discharged effluents through focused environment objectives. The integration of CWWTP with chemical treatment systems is right step in this direction. For the first time in the country, JETL has succeeded in recovering the silver from the waste generated in its laboratories and set another record.

The need for monitoring plant performance was recognized right from the inception of the CETP and a laboratory was concurrently established in 1989 for the continuous monitoring of waste water samples and CETP performance. The laboratory was subsequently upgraded in phases. At present, apart from monitoring CETP performance, JETL-Laboratory undertakes R&D related to improvement of plant performance and developing solutions for operational problems. The laboratory of JETL has been recognized as an environmental laboratory by the ministry of environment and forests, Govt. of India in the year 2002.The laboratory provides technical and analytical support to the industry units located in and around Hyderabad, on

environmental management. JETL lab participates and also executes inter-laboratory quality control exercises for validation of data. Sampling and analysis of samples is done in strict adherence to safety norms. Waste water generated from laboratory is sent to the treatment plant through closed pipe line for treatment and disposal. Chemical residues from the analysis of COD and chloride are collected separately and metals viz., silver and mercury are recovered from these liquid residues.

5. MATERIALS & METHODS

Untreated waste water comprises a collection of pathogenic microorganisms; it also contains nutrients, stimulating the growth of aquatic plants, and may contain toxic and probably mutagenic or carcinogenic compounds. The organic component of the waste water comprises proteins (5%), Carbohydrates (40%), fats and oils (10%) and the trace amounts of pollutants and surfactants.

Industrialization of the country produces large volume of liquid and solid wastes daily. The quality of these wastes depends up on the nature of the industry and type of treatments given these waters before their release from factory premises. In India seven categories of heavy polluting industries have been identified by CPCB, These industries discharge their effluents in to city sewage system, nearby water bodies or adjoining agricultural lands which cause environmental problem [15].

5.1. Effluent Treatment Process

Water is discharged from different areas contains organic, inorganic components and decomposition products, giving rise to a polluted liquid. Therefore, Treatment of this polluted liquid is recognized as one of the most burning issues. Various physico–chemical, biological process is usually employed to remove pollutants from industrial waste waters before discharging in to environment. In recent years, the need for safe and economical methods for the elimination of contaminants from waste water has necessitated [16].

5.2. Sample Collection

The Effluent is transported to the treatment plant with the help of transporting tankers. Ensured the each Tanker vehicle at air sampling point. and removed the manhole cover of the tanker. Supplied compressed air inside the tanker for 2 – 3 min. for complete mixing of the waste water. Collected the samples from top and bottom of the non local effluent tanker at sampling point & see that same sample handover to the control lab for quality analysis. Collected the sample from bottom of the local effluent tanker at sampling point & see that same sample handover to the control lab for quality analysis. After getting acceptance slip from lab unload the tanker in the respective equalization tank.

A well equipped laboratory is provided in the treatment plant, to check the characteristics of raw waste water i.e., pH, TDIS, NH3, and COD under acceptable limits of the respective industry and then the effluent is allowed to unload in to Equalization unit. If above mentioned parameters are not within the prescribed limits, then the tankers will be rejected and sent back to the particular industry for pre-treatment.

5.3. Industrial Waste Water Treatment

Table 1: physic chemical parameters sample results in the present study.

Table 1 Laboratory Parameters

pH value Total solids(TS) Total Volatile Solids(TVS) Total Dissolved Solids(TDS) Total Volatile Dissolved solids(TVDS) Suspended solids(SS) Volatile Suspended Solids(VSS) Chloride(Cl) Sulphate(SO_4) Calcium(Ca) Magnesium(Mg) Total Phosphorous(P) Acidity Alkalinity Chemical Oxygen Demand(COD) Biochemical Oxygen Demand(BOD)	BOD Rate constant Ammonical Nitrogen(N) Kjedhal Nitrogen Nitrite Nitrogen(N) Cyanide(Cn) Boron(B) Sulphide(S) Phenols(C_6H_5OH) Heavy Metals: Cadmium (Cd), Cobalt (Co), Nickel (Ni), Lead (Pb), Chromium (Cr). Toxic Metals: Arsenic (Ar), Selenium (Se), Mercury (Hg). Micro-Nutrient Metals: Iron (Fe), Copper (Cu), Manganese (Mn), Zinc (Zn), Calcium (Ca), Magnesium (Mg) and Boron (B). Pesticides. Elemental analysis like Carbon (C), Hydrogen (H), Nitrogen (N), Sulfur (S) and Oxygen (O). Oxygen Uptake Rate to determine Biodegradability of waste waters.

In addition to the above the laboratory is also equipped to conduct Jar Testing for determining the coagulant aid dosage requirement.

5.4. Sample Analysis at JETL CETP

For evaluating the performance of the treatment plant CWWTP, the supervising staff collects samples from specified sampling points at fixed intervals. These samples are sent to main laboratory for analysis. The samples are stored in refrigerator till analysis is started and completed. In order to determine water quality samples of water analyzed in the laboratory According [17, 18, 19].

In the present study though different Physico chemical parameters were analyzed like PH, Temperature, BOD, Oil & Grease, SS, Ammonical nitrogen as N, Chemical Oxygen Demand, Lead, Total Chromium, Copper, Zinc, Nickel, TDIS, Cyanide, Chloride, Sulphate, Phenolic Compounds, Arsenic as As, Cadmium as Cd, Fluoride as F, Boron as B, Total Residual Chlorine, Total Nitrogen, Sulphide as S.

5.5. Biological Treatment for Low TDS Waste Water

Biological treatment processes are used primarily for secondary treatment and they use microbial action to decompose suspended and dissolved organic waste water. Microbes use the organic compounds as they both act as a source of carbon and as a source of energy. Success of biological treatment depends on many factors such as the pH, temperature, nature of pollutants, nutrient requirement of microbes, presence of inhibiting pollutants and the variations in feed stream loading.

In JETL the treatment is done in two stages, they are:

5.5.1. Primary Treatment

It involves a number of unit processes to eliminate undesirable characteristics of wastewater.. Processes include use of screen sand grates for removal of large particles, grinding of coarse solids, pre-aeration for odour control and some removal of grease.

Primary waste water treatment, at times, is the first step in the waste water treatment process. It involves physical separation of suspended solids from the waste water by using primary clarifiers. This is help full in reduction of total suspended solids (TSS) and associated Biological oxygen demand. This process involves decomposition of suspended solids and dissolved organic matter in waste water using microbes (CPCB, Undated)**.** In primary treatment with the help of Equalization tank and Clariflocculator the large colloidal solids or suspended solids or floating organic solids are removed in percentages for easy discharge of effluents into secondary treatment.

5.5.2. Secondary Treatment

It involves purification of wastewater primarily by decomposition of suspended and dissolved organic matter from microbial action. A number of processes are available but mainly used are land treatment, activated sludge process or the biological filtration methods.

In secondary treatment there is a removal of biodegradable organic matter (in solution or suspension) and suspended solids. Disinfection is also typically included in the definition of conventional secondary treatment.

In addition to primary treatment and secondary treatment, wastewater treatment could undergo (i) preliminary treatment, where it involves a number of unit processes to eliminate undesirable characteristics of wastewater. Processes include use of screen sand grates for removal of large particles, grinding coarse solids, pre-aeration for odour control and some removal of grease. (ii) Auxiliary treatment includes large number of physical and chemical treatment processes that can be used before or after the biological treatment to meet the treatment objectives [20].

6. RESULTS & DISCUSSIONS

In the present study water samples were analyzed and the wastewater results are confirmed that all the results of parameters are within the standards after the treatment (See Appendix). So with the help of different treatment methods pollution levels can be decreased so with the more effective effluent treatment methods have to use in water treatment.

Quantity and quality are two major issues involved in the use of water. The main purpose of analyzing physical and chemical characteristics of water is determining its ecological status. The physic-chemical parameters such as temperature, pH, Dissolved Oxygen, organic, inorganic constituents' play an important role in determining water quality, nature of water sample and it is also the prime considerations to accesses water quality [21].

In present study total samples were collected at 14 places in effluent treatment plant (Table 3), results are compared with standard results which were presented in (Table 4).

Table 2 Description of Sample at various section of CETP

S.No.	Description of the sample	Parameters
1	Inlet to flocculator	pH, SS (Daily)
2	Outlet to flocculator	pH, SS (Daily)
3	Buffer storage tank outlet	pH, TDS (Daily) COD, NH_3 (Weekly trice)
4	Nallah sewage	pH, TDS (Daily), COD (Weekly Once)
5	DC_2 Sewage	pH, TDS(Daily)TDIS, TDVS, COD, NH_3 (Weekly Once)
6	DC_2 Outlet	pH, TDS, SS, COD, NH_3, SS, BOD, Alkalinity(Daily) Phenol, NO_3,TKN (Weekly Once)
7	ASP'S Samples	pH, MLSS, D.O (Daily), MLVSS (Weekly Once)
8	FC_1 Outlet	pH (Daily)
9	Thickener inlet	SS
10	Condensate inlet	pH
11	Condensate Outlet	pH, TDS(Daily),NH_3,COD (Weekly twice)
12	Decanter Inlet	%Solids (Weekly Once)
13	Decanter cent rate	%Solids (Weekly Once)
14	Decanter Cake	Moisture (Weekly Once)

Table 3 Treated effluent quality standards and Result for JETL CETP

S. No.	Test parameters	Units	Standards	Result
1	pH	-	5.5-9.0	7.68
2	Temperature		40^oC	25.2
3	BOD at 27^0 C	Mg/L	30	<10
4	Oil & Grease	Mg/L	10	2
5	TSS	Mg/L	100	<50
6	Ammonical nitrogen as N	Mg/L	50	BDL
7	Chemical Oxygen Demand-COD	Mg/L	500 (from April'08)	110
8	Lead	Mg/L	0.1	0.01
9	Total Chromium	Mg/L	2	BDL
10	Copper	Mg/L	3	BDL
11	Zinc	Mg/L	5	0.16
12	Nickel	Mg/L	3	0.19
13	TDS	Mg/L	2100	1450
14	Cyanide	Mg/L	0.2	BDL
15	Chloride	Mg/L	1000	300-450
16	Sulphate	Mg/L	1000	135-175
17	Phenolic Compounds	Mg/L	1	0.28
18	Arsenic as As	Mg/L	0.2	BDL
19	Cadmium as Cd	Mg/L	1	BDL
20	Fluoride as F	Mg/L	2	1.08
21	Boron as B	Mg/L	2	0.8
22	Total Residual Chlorine	Mg/L	1	BDL
23	Total Nitrogen	Mg/L	100	3
24	Sulphide as S	Mg/L	2.8	BDL

7. CONCLUSION

The major environmental concern is an urbanizing India relate to high levels of water pollution due to poor waste disposal, inadequate sewerage and drainage, and improper disposal of industrial effluents. The CETP (Common Effluent Treatment Plant) has been modified to operate as the first combined waste water treatment plant (CETP) in India treating industrial waste along with domestic sewage. It is successful in its treatment. The process achieves greater than 95% BOD removal and maintains low BOD to COD ratio. Operation and maintenance in the plant is maintained strictly and also follows all the safety rules. Each and every treatment unit as per the design requirements and also can accommodate future inflow.

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